

1      Riser Connector2      Background of the Invention

3      This invention relates to a riser connector and  
4      method for connecting pipes or risers used to  
5      transport fluids, particularly pipes or risers used  
6      in the offshore oil and gas industry to transport  
7      fluids from well-heads at the sea-bed to the surface.

8      Risers can comprise a string of pipes extending for  
9      thousands of feet. The connections between the  
10     individual pipes need to be secure for structural  
11     integrity of the riser, and need to avoid leaking  
12     fluids into the sea, and seepage of sea water into  
13     the pipe string. Moreover, risers typically need the  
14     capacity to bend somewhat to cope with the underwater  
15     currents. The bending forces applied to a particular  
16     pipe in the string are normally transferred to  
17     adjacent pipes via connections between the pipes so  
18     that the string as a whole absorbs the force. The

1 connections between the pipes therefore need to be  
2 secure and capable of transferring such loads.  
3 Pipes used in such applications typically have a  
4 'box' connector at one end and a 'pin' connector at  
5 an opposite end. A typical connection is shown in  
6 Fig. 1. The pin 3 of pipe 1 is threaded into the box  
7 4 of pipe 2 to engage the threads 5, 6 provided on  
8 the pin 3 and box 4 respectively.

9

10 To connect the pipes 1, 2 in this way requires a  
11 significant amount of torque - typically 50,000  
12 ft/lb. on a 10-3/4" riser connector. The pin 3 and  
13 box 4 are typically gripped in the pingrip portion 7  
14 and the box reaction grip portion 8 respectively as  
15 shown in Fig. 2.

16

17 The requirement to transfer forces across the pipe  
18 connections means that the threads in the box and pin  
19 need to be very close in tolerance, in order to  
20 ensure that the riser bends smoothly along its length  
21 rather than at the connections between pipes.

22

23 Summary of the Invention

24 According to a first aspect of the invention there is  
25 provided a connector for connecting a first tubular  
26 to a second tubular; the connector comprising a first  
27 portion on the first tubular and a second portion on  
28 the second tubular, wherein the first and second  
29 portions each have axially extending portions which  
30 in the assembled connector are mutually parallel.

31

1      Typically the first and second portions have mutually  
2      engaging threaded portions. Typically the axially  
3      extending portions are unthreaded. Preferably the  
4      axially extending portions are load-bearing and allow  
5      the transfer of loads between the tubulars.

6  
7      Preferably two axially extending portions are  
8      provided on each tubular. Preferably the first  
9      axially extending portion on each tubular is greater  
10     in length than the second axially extending portion  
11     on each tubular. Preferably the axially extending  
12     portions on each tubular are provided above and below  
13     the threaded portion. Preferably a spigot and a  
14     socket comprise the axially extending portions on  
15     each tubular. Preferably the spigot is provided  
16     between the tubular's threaded face and terminus.  
17     Preferably the spigot on the first tubular engages  
18     the socket on the second tubular. Preferably the  
19     spigot on the second tubular engages the socket on  
20     the second tubular.

21  
22     Typically the first tubular comprises a pin  
23     connector. Typically the second tubular comprises a  
24     box connector. Preferably the socket of the first  
25     tubular and spigot on the second tubular are greater  
26     in the length than the socket of the second tubular  
27     and spigot of the first tubular.

28  
29     Typically the axially extending portions are parallel  
30     to the axis of the tubulars, but this is not  
31     essential.

1 Preferably the first and second tubulars have a  
2 tapered profile. Preferably the tapered portions of  
3 the first and second tubulars are the threaded  
4 portions of the first and second tubulars and have  
5 co-operating tapers to facilitate mating of the two  
6 portions.

7

8 Typically at least one seal is provided. Most  
9 typically two seals are provided. A first seal  
10 typically prevents ingress of fluid (e.g. sea water)  
11 from outside the connection of the connector to the  
12 threaded and axially extending portions of the  
13 connection. A second seal typically prevents fluid  
14 (e.g. production fluids) being released from inside  
15 the connection to the threaded and axially extending  
16 portions of the connection.

17

18 Preferably the seal is formed from differential angle  
19 tapers on each spigot and socket, although any  
20 sealing means may alternatively be used.

21

22 According to a second aspect of the invention there  
23 is provided a method for connecting a first tubular  
24 to a second tubular the method comprising the steps  
25 of-

26 gripping a first tubular at a position spaced  
27 from its terminus;  
28 engaging the first and second tubulars;  
29 gripping the second tubular; and  
30 applying torque between the tubulars.

31

1      Typically the first tubular's outer diameter  
2      increases near its terminus to form a tapered portion  
3      or 'pin'.

4

5      Normally the first tubular's inner diameter remains  
6      constant.

7

8      Preferably the first tubular is gripped at a portion  
9      before the point that its outer diameter increases.

10

11     Normally the pin has a thread.

12     Typically the second tubular's outer diameter  
13     increases near its terminus to provide a receiving  
14     portion or 'box'.   Normally the box has a thread  
15     which can engage the thread of the pin to form a  
16     connection between the first and second tubulars.

17

18     Typically the first connector and second connector  
19     are also sealed together by any suitable means.

20

21     The portions can simply have an axially extending  
22     component and can be deviated slightly from the axis,  
23     provided that in the assembled connector they are  
24     mutually parallel.

25

26     The length and thickness of the axially extending  
27     portions may depend on the length, size or weight of  
28     the tubulars connected.   Typically the tubulars  
29     connected are 45ft long, although they may be, for  
30     example, anywhere from 30ft to 90ft long.   Typically  
31     the first axially extending portion on each tubular

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1 is at least 2" long. Preferably the first axially  
2 extending portion on each tubular are 3.5" long.  
3 Most preferably the first axially extending portion  
4 on each tubular is 6" long. Typically the second  
5 axially extending portion on each tubular is at least  
6 0.5" long. Preferably the second axially extending  
7 portion on each tubular is 1" long. Most preferably  
8 the second axially extending portion is 2" long.

9

10 The axially extending portions may be between  $0.5t$   
11 and  $3t$  thick wherein 't' is the thickness of the  
12 respective tubular. Preferably the axially extending  
13 portions are between  $1t$  and  $1.5t$  thick.

14

15 Brief Description of the Drawings

16 Embodiments of the invention will now be described by  
17 way of example only with reference to the  
18 accompanying drawings, wherein;

19

20 Fig. 1 is a sectional view of a standard prior  
21 art box and pin connection;

22

23 Fig. 2 is a second sectional view of a standard  
24 prior art box and pin connection;

25

26 Fig. 3 is a sectional view of a box and pin  
27 connection according to the second aspect of the  
28 invention;

29

30 Fig. 4 is a sectional view of a box and pin

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1 connection according to the first aspect of the  
2 invention;

3  
4 Fig. 5 is a third sectional view of a standard  
5 prior art box and pin connection;

6  
7 Fig. 6 is a second sectional view of a box and  
8 pin connection according to the first aspect of the  
9 invention;

10  
11 Fig. 7 is a third sectional view of a box and pin  
12 connection according to the first aspect of the  
13 invention during assembly;

14  
15 Fig. 8 is a sectional view of a thread used in a  
16 standard prior art box and pin connection; and,

17  
18 Fig. 9 is a sectional view of the thread  
19 used in a box and pin connection according to the  
20 first aspect of the invention.

21  
22 Description of the Preferred Embodiments

23 Referring to the drawings, an embodiment of a  
24 connector for pipes in accordance with a first aspect  
25 of the invention is shown in Figs. 4, 6, 7 and 9 in  
26 which pipes or tubulars 9, 10 each have a threaded  
27 pin portion 11 and threaded box portion 12.

28  
29 Fig. 4 shows the pin 11 and box 12 portions in their  
30 connected position. The pin portion 11 has a spigot  
31 13 and a socket 14. The box portion 12 also has a

1 box spigot 15 and a box socket 16. Preferably the box  
2 spigot 15 and pin socket 14 have a greater axial  
3 length than the pin spigot 13 and box socket 16 as  
4 shown in Figs. 6 and 7. Typically the larger box  
5 spigot 15 and box socket 16 are at least 3.5" in  
6 length and the smaller pin spigot 13 and pin socket  
7 14 are at least 1" in length assuming the length of  
8 the tubulars 9, 10 is 45ft; the box and pin spigots  
9 15, 13 and pin and box sockets 14, 16 are typically  
10 proportional with respect to the size and weight of  
11 the tubulars 9, 10.

12

13 The box and pin spigots 15,13 are arranged  
14 concentrically within the pin and box sockets 14, 16  
15 respectively and both the spigots 15,13 and sockets  
16 14, 16 are parallel to the axis of the tubulars 9,  
17 10, and are thereby adapted to transfer load from one  
18 tubular 9, 10 to another. The pin portion 11 and box  
19 portion 12 have threads 17, 18 respectively for  
20 connecting the pin portion 11 to the box portion 12.  
21 Consequently, the threads 17, 18 need not be adapted  
22 to transfer radial loads and can therefore be looser  
23 than prior art threads used in risers.

24

25 In contradistinction, prior art threads in known  
26 riser connectors are shown in Fig. 8. The pin 3 is  
27 provided with threads 5 and the box 4 is provided  
28 with threads 6. When one of the tubulars 9, 10 moves  
29 in any given direction, the radial portion of the pin  
30 threads 5 on a first side of the connector transfers  
31 the bending load to the other tubular 9, 10 via

1 opposite radial portions on the opposite box threads  
2 6. Such threads 5, 6 need to be carefully  
3 engineered.

4  
5 Certain embodiments of the first aspect of the  
6 invention allow the use of far simpler threads which  
7 need not be designed to transfer bending loads. Such  
8 threads are shown in Fig. 9 and it can be seen that  
9 the threads are much looser compared to the prior art  
10 threads 5,6 of Fig. 8.

11  
12 The looser pin and box threads 17, 18 respectively  
13 reduce manufacturing costs and ease inspection of the  
14 tubular connections. The associated savings accrue  
15 from all connections in a pipe string to provide a  
16 significant cost saving.

17  
18 To form the connection between the pin portion 11 and  
19 box portion 12, each pipe is gripped by tongs and the  
20 pin portion 11 is inserted into the box portion as  
21 shown in Fig. 7. The box socket 16 and spigot 15  
22 abut and align the pin portion 11 with the box  
23 portion 12 before their respective threads 17, 18  
24 engage. Such alignment is a further advantage of the  
25 box socket 16 and spigot 15 as threads used in such  
26 connectors are prone to damage during this stage of  
27 the assembly of tubulars. The pipes 9, 10 are then  
28 counter-rotated and the threads 17, 18 engage to form  
29 a connection.

30

1 Once the connection is made, the box spigot 15 on the  
2 box portion 12 engages the pin socket 14 on the pin  
3 portion 11. Similarly, the pin spigot 13 on the pin  
4 portion 11 engages the box socket 16 on the box  
5 portion 12.

6

7 Seals 19, 20 are provided between the pin and box  
8 portions 11, 12 respectively. A reservoir seal 19  
9 prevents reservoir fluids escaping from the inner  
10 bore of the tubulars into the connection. A seawater  
11 seal 20 prevents sea water from entering from outside  
12 the pipe 9, 10 string into the tubulars 9, 10. The  
13 reservoir and sea seals 19, 20 are standard  
14 differential angle tapers, with lips on the pin and  
15 box portions 11, 12 respectively engaging each other.

16

17 The box and pin spigots 15, 13 respectively and the  
18 box and pin sockets 16, 14 allow load transfer  
19 between the pipes 9, 10 without requiring the tight  
20 threads typical in the prior art.

21

22 When for example, the first pipe 9 is subject to a  
23 bending force, the pin spigot 13 and socket 14 of the  
24 pin portion 11 abut respectively against the box  
25 socket 16 and spigot 15 of the box portion 12,  
26 transferring the load to the second pipe 10. Load  
27 transfer is indicated by the arrows referenced by  
28 reference numerals 21, 22 in Figure 6. Thus bending  
29 loads applied to a particular section of pipe are  
30 dispersed over the string as a whole by the  
31 interaction of the box and pin spigots 15, 13

1 respectively and the pin and box sockets 14, 16.  
2 Consequently a relatively loose thread profile -  
3 compared with prior art connectors - may be employed  
4 without detracting from the overall integrity of the  
5 seal and connection between the pipes 9, 10.  
6

7 An embodiment of a connector according to a second  
8 aspect of the invention is shown in Fig. 3. As shown  
9 in Fig. 3 a first pipe 23, comprises a pin portion 11  
10 and a pipe 24 comprises a box portion 12 at a second  
11 end of the second pipe 24. The pin portion 11 and box  
12 portion 12 have complementary threads 25, 26  
13 respectively.

14  
15 The pipes 23, 24 are connected by gripping the pipe  
16 24 at a box portion head area 28 by tongs and the  
17 first pipe 23 at a first pipe area 29 of the first  
18 pipe 23. Therefore, the head of the pin portion 11  
19 can be much smaller compared with prior art  
20 connectors because the pipe 23 is gripped and not the  
21 pin head. This reduces the metal required to form a  
22 connector without reducing the size of the pin and  
23 box portions 11, 12. Moreover, such pipes can be  
24 easier to manufacture and further costs can be saved.  
25

26 The connection between the two pipes is thereby  
27 effected using less material and without compromising  
28 the quality of the connection or seal. The numerous  
29 connections in a pipe string leads to a significant  
30 saving in material, weight, manufacturing complexity,  
31 and the cost of the riser.